Logical Aspects of MAS

Foreword

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Foreword

Logical aspects of multi-agent systems (MAS) is a young and dynamic field of interdisciplinary research on the border of logic, artificial intelligence, computer science, and game theory. It includes a variety of topics such as: logical systems for modeling, specification, analysis, and reasoning about MAS; deductive systems and decision methods for logics for MAS; development, complexity analysis, implementation, and applications of algorithmic methods for formal verification of MAS.

This special issue was conceived as a post-proceedings volume of the Workshop on Logical Aspects of Multi-Agent Systems (LAMAS 2010), organized by us as a satellite event of AAMAS 2010 on May 11, 2010 in Toronto, Canada. The special issue consists of 4 contributions representing a fine blend of technically different, yet conceptually interrelated logical aspects of multi-agent systems.

– *In* "Epistemic planning for single- and multi-agent systems" *Thomas Bolander and Mikkel Birkegaard Andersen propose using event models, arising from the semantics of dynamic epistemic logic, for automated planning of sequences of actions of agents towards achieving their specific objectives. The authors show how to model multi-agent planning problems using Kripke-models for representing world states and event models for representing actions, suitably modified in order to model the internal views of agents rather than those of an external observer. They generalize the classical AI concept of planning domains to 'epistemic planning domains' and show how epistemic planning can deal with partial observability, nondeterminism, knowledge and multiple agents. As main technical results, the authors show that epistemic planning is decidable in the single-agent case, but only semi-decidable in the multi-agent case.*

– *The paper* "Justifications for Common Knowledge" *by Samuel Bucheli, Roman Kuznets, and Thomas Studer is about multi-agent justification logics. These are epistemic logics that explicitly include justifications for the agents' knowledge. The authors develop a new multi-agent justification logic with evidence terms for individual agents as well as for common knowledge. They define formal Kripke-style semantics for it, similar to Fitting's semantics for the Logic of Proofs LP, provide a sound and complete axiomatic system for their logic, and establish its finite model property. As an application they provide a brief analysis of the coordinated attack problem in that logic.*

– *In* "Converse-PDL with Regular Inclusion Axioms: A Framework for MAS Logics" *Barbara Dunin-Keplicz, Linh Anh Nguyen, and Andrzej Szałas study automated reasoning in a modal logic CPDL$_{reg}$, combining the Propositional Dynamic Logic with Converse and the Regular Grammar Logic with Converse, for which they provide a sound and complete tableau calculus. The authors propose and advocate the use of CPDL$_{reg}$ as a technical framework for reasoning about agency and argue*

that many expressive multi-agent logics can be translated into it, and therefore it can be used as a platform for automated deductive reasoning in multi-agent logics.

– *In* "An Alternating-time Temporal Logic with Knowledge, Perfect Recall and Past: Axiomatization and Model-checking" *Dimitar Guelev, Catalin Dima, and Constantin Enea present a variant of the alternating-time temporal logic ATL with imperfect information which includes the distributed knowledge operators corresponding to synchronous action and perfect recall. The cooperation modalities assume that distributed knowledge is used to define the knowledge of coalitions, and accordingly the set of strategies. The authors propose a model checking algorithm for that logic, based on techniques for games with imperfect information and partially observable objectives, and involving deciding emptiness for automata on infinite trees. They also propose an axiomatic system and prove its completeness for an expressive subset of the language.*

We believe that this special issue demonstrates the vitality of the idea of applying logic to formalization and reasoning in, and about, multi-agent systems. The selection of papers emphasizes also the diversity of the logical aspects of MAS. We hope that the readers will share our optimism about the potential and the future of this, still emerging, field of research.

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